

# Scissor-Knot-Pusher: An Instrument for Simplified Laparoscopic Extracorporeal Knotting

Stefano Olmi, MD, Enrico Croce, MD

## ABSTRACT

This paper describes the “scissor-knot-pusher,” an instrument that greatly facilitates the execution of knot tying during laparoscopic operations. The instrument acts in essence as an extension of the surgeon’s hand and, given its rigid structure, allows the surgeon full control of the process of knot tying. Additionally, after the knot has been tightened, it is possible to cut the suture without using a different instrument. As a result, this technical device simplifies knot tying and may help to reduce the frustration and the time often associated with intracorporeal suturing during laparoscopic surgery.

**Key Words:** Laparoscopy, Laparoscopic suture, Extracorporeal knots, Suturing techniques, Knot-pusher.

## INTRODUCTION

When performing minimally invasive laparoscopic and thoracoscopic surgery, using an extracorporeal knotting technique can facilitate suturing. In minimally invasive surgery, the most common technique for suturing (for example in Nissen Rossetti fundoplication, a blood vessel, a cystic duct, or at the base of the appendix) consists of the standard extracorporeal knot technique. With the “scissor-knot-pusher” (**Figure 1**), which we use and which was developed by Braun–Aesculap, it is possible to do this with speed, ease, and reliability. This instrument makes it possible to tie various kinds of knots with suture that is 90 cm or longer. Not only is it much easier to tie slipknots like the Roeder knot, but more importantly, the instrument also allows surgeons to tie the simple and double surgical knots commonly used in open surgery. Additionally, the instrument can be used as a normal knot tier and can be used to form a loop. After a loop has been formed, the instrument can be used to manipulate the loop. The characteristics of this instrument make it possible to tighten a loop in any limited space, such as the pelvic canal or the esophageal hiatus, even in obese patients. Used in this manner, it is possible to apply vascular ligature to reinforce colorectal anastomosis and to perform cholecystectomy, gastrofundoplication, to suture gastrointestinal perforations, and to make intestinal anastomoses. Finally, after the knot has been tightened, it is possible to cut the suture, with the part before the hole (**Figure 2**) without changing the instrument.

## KNOTTING TECHNIQUES

After being introduced into the cavity, the needle is drawn through the two edges of tissue to be stitched and pulled out of the trocar through which it was inserted. The other end of the suture remains outside the trocar. The surgeon then quickly makes the surgical knot or slipknot.

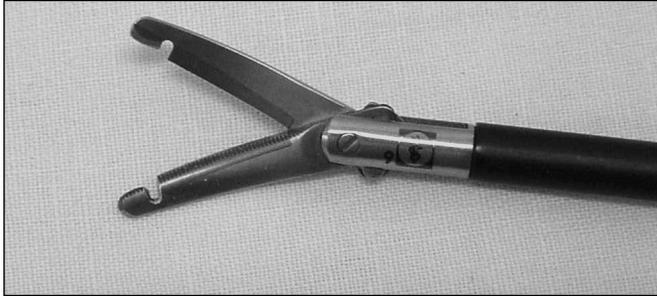
## Simple and Double Surgical Knots

With both suture ends outside the trocar, the surgeon’s needle is threaded through the hole as the dominant

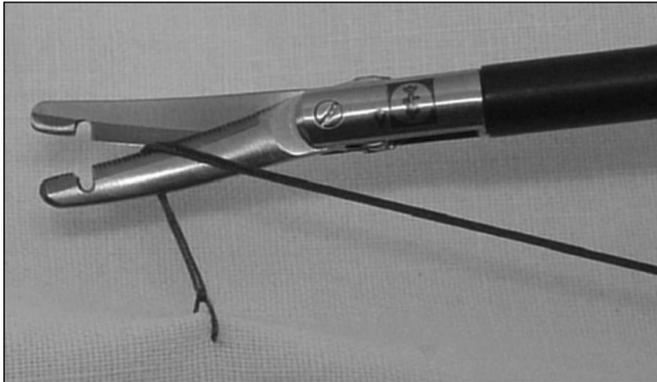
Department of Surgery, Center of Laparoscopic and Minimally Invasive Surgery, Milan, Italy (all authors).

Address reprint requests to: Stefano Olmi, MD, Via Solferino 42, 20121 Milan, Italy. Telephone: 39 0263632430, Fax: 39 0263632460, E-mail: stefano.olmi@tiscali.it.

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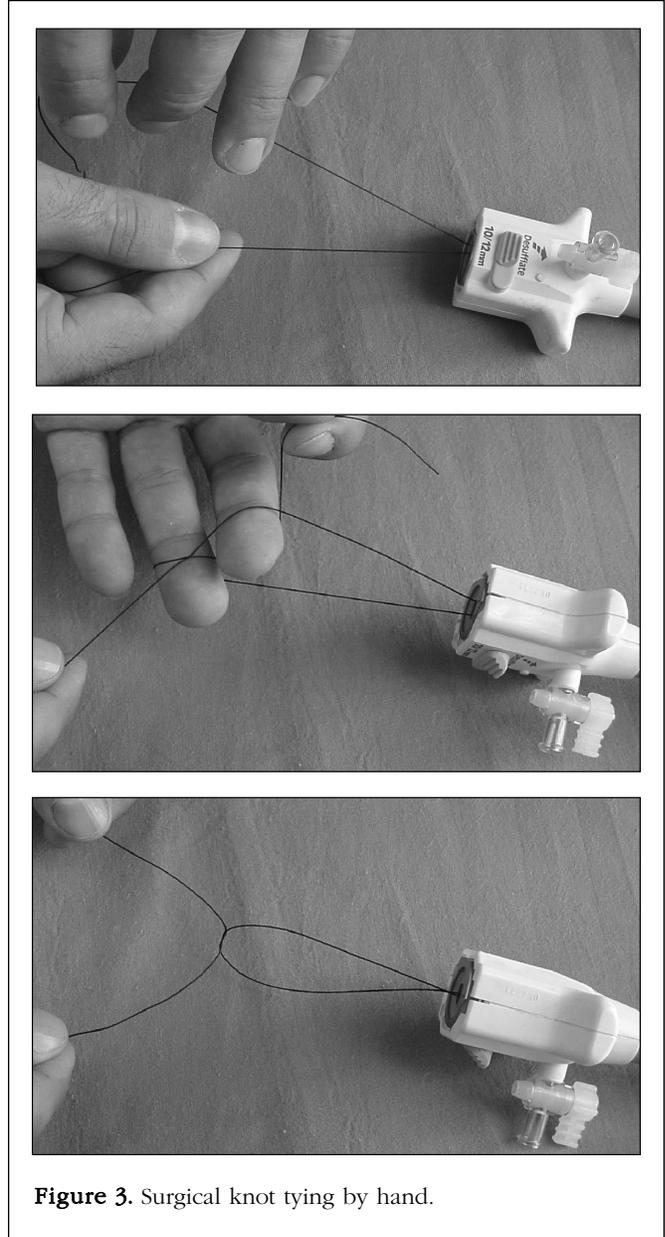


**Figure 1.** Scissor-knot-pusher.



**Figure 2.** Scissor-knot-pusher being used to cut.

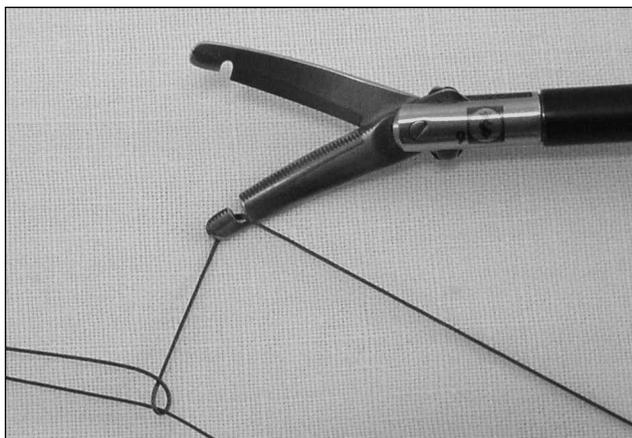
hand holds the instrument and part of the suture at the needle end while the simple or double surgical knot is tied before with the nondominant hand (**Figure 3**). It is possible to make a surgical knot and afterwards close the scissor-knot-pusher around the suture before the knot (**Figure 4**). After both ends of the suture are held in the nondominant hand, the dominant hand merely has to push the instrument to tighten the knot in the body cavity as if the surgeon's hand were doing this (**Figure 5**). The terminal part of the instrument, used to slide the knot, can be placed immediately after the knot in the same way a surgeon's fingers are placed (**Figure 6**). After the first knot has been tightened, the instrument is removed and the procedure is repeated until the desired number of knots have been made. Finally after the knot has been tightened, it is possible to cut the suture without changing the instrument (**Figure 2**).



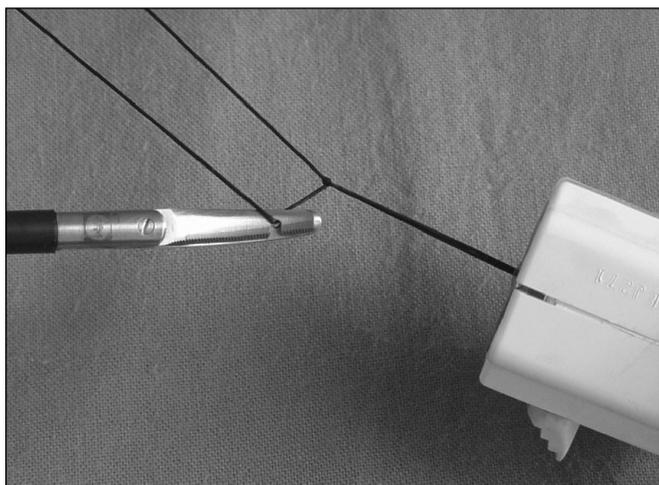
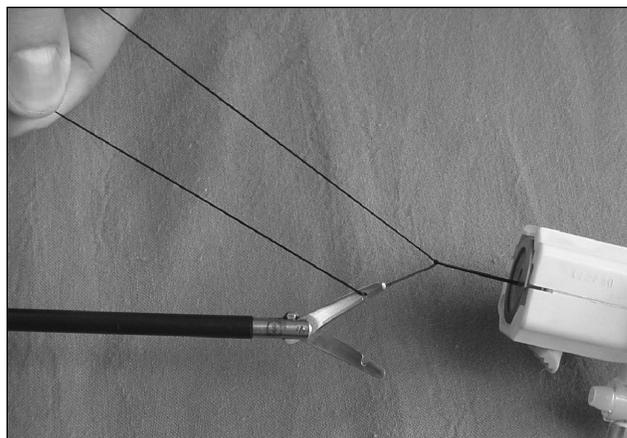
**Figure 3.** Surgical knot tying by hand.

### Slipknots

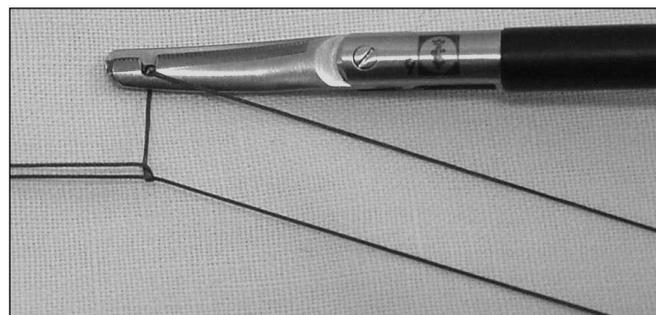
After making a slipknot (Roeder, Fisherman, Tyside), the suture is then passed through the hole. The knot can be slid down into the cavity and tightened at the structure involved. Then the suture can be cut by the same instrument. With the scissor-knot-pusher, it is also possible to more easily tie self-tightening slipknots.<sup>1</sup>



**Figure 4.** Surgical knot tying using scissor-knot-pusher.



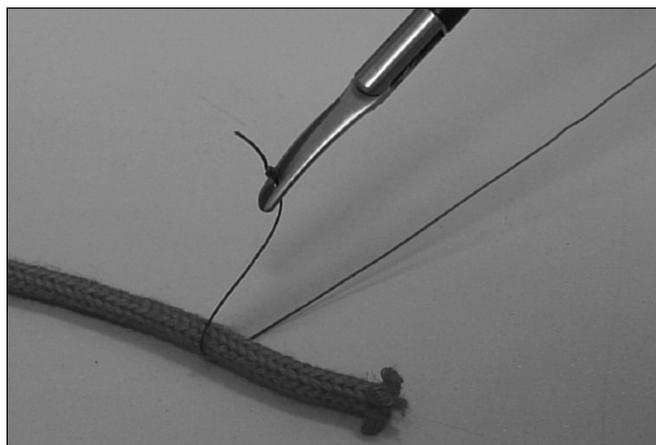
**Figure 5.** Tightening of knot using scissor-knot-pusher.



**Figure 6.** Scissor-knot-pusher placed immediately after the knot in the same way a surgeon's hands are placed.

### Endoloop

By making a slipknot (Roeder, Fisherman, Tyside) and passing the long end of the suture through the hole (or closing the instrument around the suture before the knot), the scissor-knot-pusher can be used as a normal Endoloop, with the advantage that the loop can be positioned and tightened anywhere desired with ease and utmost reliability given the length and metal structure of the instrument and by using the suture material that is



**Figure 7.** Scissor-knot-pusher being pulled out as it would be to get both ends of the suture outside a trocar.

most appropriate. Finally, the suture can be cut with the same instrument.

### Loop

This technique, which is useful for appendectomies<sup>2</sup> and also for constricting other anatomical structures, can be used to apply various types of ligatures, based on the same principle as a wire mounted on an iron rod used in open surgery. The free end of a thread 90 cm in length is knotted, and the thread is passed through the hole of the instrument so that the knotted end remains firmly attached at the hole. It is also possible to close the end of the suture between the end of the instrument because this part does not cut. The instrument with the threaded end is then pushed with one hand through the trocar, with the rest of the suture remaining on the outside. Once it is near the structure to be ligated, for example the base of the appendix, the instrument is then drawn over the structures and finally pulled out (**Figure 7**), if necessary with the help of forceps held with the other hand, so that both ends of the suture are outside the trocar. Now, it is just a matter of tying a number of surgical knots or fashioning a slipknot, such as a Roeder or Fisherman knot.

### RESULTS

We successfully use the scissor-knot-pusher and these suturing techniques in any situation needing an extracorporeal knot. Especially when making the usual surgical knot, even an inexperienced laparoscopic surgeon is able to execute an extracorporeal suture extremely safely, much more simply, quickly, and cheaply compared with any other method.

### DISCUSSION

One of the most problematic areas in the field of laparoscopic surgery is knot tying.<sup>3,4</sup> In certain instances, this hurdle is sufficiently great that laparoscopic procedures have to be abandoned. This is particularly true where organs such as the proximal stomach require suturing in

procedures like Nissen fundoplication; using the scissor-knot-pusher, it is possible to execute blood vessel bindings, a cholecystectomy, a Heller-Dor, a gastric perforation closure, a reinforcement of stapled bowel anastomosis, and intestinal anastomosis.<sup>5,6</sup> In addition, the length of the instrument allows you to tighten the knot anywhere either in pelvic reaches or at esophageal hiatus level, even in obese patients. The scissor-knot-pusher acts in essence as an extension of the surgeon's hand. Because of its rigid structure, surgeons have full control of the knot tying process. It is not necessary to change instruments to cut the suture after the knot has been tightened. As a result, the scissor-knot-pusher simplifies knot tying and may help to reduce the frustration often associated with intracorporeal suturing during laparoscopic surgery.<sup>7</sup>

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